

Syllabus

EN.500.109 Explore Engineering Innovation

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About the Course

Descriptions

Explore Engineering Innovation (EEI) is an exciting college-level summer program for motivated high school students with an aptitude in math and science and an interest in (or curiosity about) engineering. This program has been available to high school students since 2006. In the program, students learn to think and problem-solve like engineers and have the opportunity to earn Johns Hopkins University (JHU) credit.

This is a course of lectures, laboratories, and special projects. Its objective is to introduce students not only to different fields of engineering, but also to the analytic tools and techniques that the profession uses. Assignments include hands-on and virtual experiments, oral presentations of product design, and design/construction/testing of structures.

Visit our website for more information: <https://ei.jhu.edu>.

Prerequisites

- High school algebra II and trigonometry
- High school chemistry or physics
- As and Bs in high school math and science courses

Objectives

- To introduce students to prevalent topics in engineering
- To prepare students for rigorous college engineering programs
- To help students develop problem solving strategies and confidence
- To assist students in determining whether engineering is a career they are interested in pursuing

Outline

- **Module 1:** Engineering Design
- **Module 2:** Units and Dimensions
- **Module 3:** Technical Communication
- **Module 4:** Excel
- **Module 5:** Materials
- **Module 6:** Error and Uncertainty
- **Module 7:** Ethics
- **Module 8:** Statics
- **Module 9:** Finance
- **Module 10:** Electronics
- **Module 11:** Chemical Processes

Textbook and Lab Kit

This course does not have a textbook. All course materials are found on the course Blackboard site or Microsoft Teams.

A **lab kit** will be mailed to each student early in the course. If you have issues receiving your lab kit, please contact the Engineering Innovation office at ei@jhu.edu.

Teaching Team

The course is taught by an **Instructor**, typically someone with a PhD that teaches college-level courses, and a **Teaching Fellow**, typically a high school teacher. Some sections also have **TAs** that assist with the course. Teacher biographies and contact information can be found in the **Syllabus & Course Information** area of the Blackboard course menu.

While teachers will not be “on call” outside of the class meeting time, they will make every effort to respond to questions and reply in a timely fashion. Once the course begins, **please make every effort to contact the teachers through Microsoft Teams rather than email.**

See the **Access** and **Communication** sections of this Syllabus for more information.

Schedule

Students should expect to spend 5 ½ hours per weekday on this course:

1. **Self-study:** Each day begins with approximately **1 hour** of independent work to cover new material. This includes watching pre-recorded lectures, reading, and solving simple practice problems. Students should complete this work on their own time.
2. **Synchronous 3-hour class meeting:** The second block of time is 2 ½ hours of work during the synchronous **3-hour** session that was assigned during course enrollment. Students work for three blocks of 50 minutes with 15-minute breaks in between. Most of this time is spent working in small groups.
3. **Homework:** The day ends with a homework assignment that is designed to take **1 ½ hours** to complete. This work may be independent or group work.

A calendar with due dates is available in the **Calendar** area of the Blackboard course menu. Unless otherwise noted, **all homework must be submitted to Blackboard before the next class meeting begins.**

Access

Required Software

To complete the course, students need access to a computer with the following capabilities:

- Access to a spreadsheet application which will allow them to analyze data*
- Access to a word processing program that can be used to write their course lab reports*
- Access to a presentation program so they can create a presentation for their final project*
- Ability to upload videos to the internet
- USB port to communicate with the Adafruit Circuit Playground Express
- Reliable internet access

*All students are granted a Microsoft Office 365 license during the program.

Johns Hopkins Online Account

The Johns Hopkins Enterprise Directory (JHED) system is an online, comprehensive source of contact information for Johns Hopkins University faculty, staff, and students that grants access to the following resources:

- [Blackboard](#) – access the course files (lecture videos, assignments, etc.)
- [Microsoft Teams](#) – communicate with the class
- [Microsoft Office 365](#) – access Word, Excel, PowerPoint, OneDrive, etc.
- [myJHU](#) – view and update your student profile
- [SIS](#) – view your final grade at the end of the course
- [Library](#) – access online reference materials

Sign in to these applications using **JHEDID@jh.edu** (**NOT @jhu.edu**) and your password.



Sign in

jhedid@jh.edu

[Can't access your account?](#)

[Sign-in options](#)

Back

Next



← kborgsm1@jh.edu

Enter password

Password

[Forgot my password](#)

Sign in

New students should receive an email from the registrar containing their JHED ID shortly after enrollment. Instructions for activating the account are provided in the **Online Account Activation Instructions Form** during course enrollment. Contact webregistration@jhu.edu or call 410-516-8080 for assistance, if needed.

Blackboard – Course Materials

Most course materials will be provided through [Blackboard](#). Students sign into Blackboard using their JHED username and password.

The daily class schedule can be found in the **Syllabus & Course Information** area of Blackboard. The lectures, assignments, and quizzes are divided into modules, which can be accessed by clicking **Course Modules** on the Blackboard course menu. Upcoming assignment deadlines and course grades are visible in the **Calendar** and **My Grades** areas.

Microsoft Teams – Class Meeting and Communication

This course will use [Microsoft Teams](#) for communication, including the daily synchronous class meeting. This is a platform that works in a browser, desktop application, and app for tablet and phone (iOS and Android).

Students can access Teams by clicking **Microsoft Teams** on the Blackboard course menu or navigating to <https://teams.microsoft.com>. After signing in, the course Team will be listed on the left-hand side with the Team channels (discussion areas) listed below. **Module** channels are for questions and topics related to specific modules. Students can open the **Meetings** channel to view upcoming meetings or [join a meeting in progress](#).

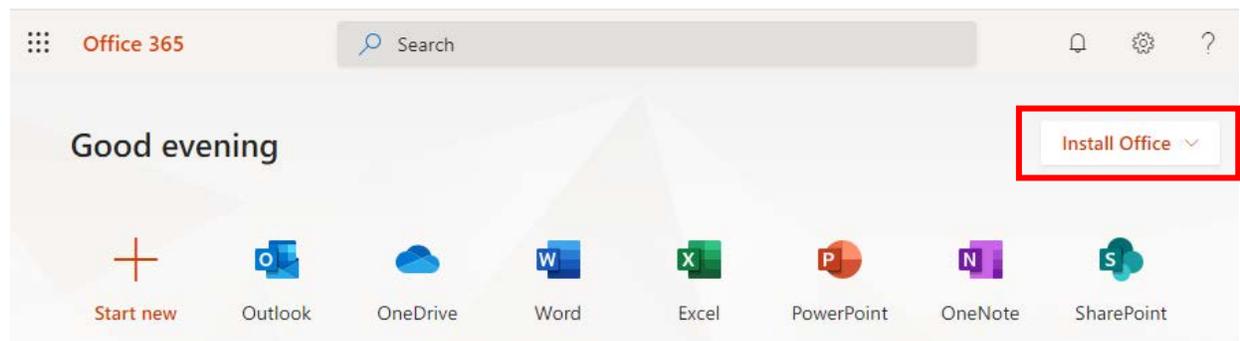
Students can customize channel notifications by clicking the dots next to the channel name and selecting **Channel notifications**. It is also possible to [configure email notifications, alert sounds, and more](#).

For more information, check out the [Microsoft Support information](#) for getting started with Microsoft Teams. For assistance with signing in or accessing Microsoft Teams, please contact the Help Desk at wse-is@jhu.edu.

Microsoft Office 365 Software

Students have access to the Microsoft Office 365 Suite software (Microsoft Word, PowerPoint, Excel, etc.) for the duration of the course. To access:

1. Go to <https://www.office.com> and click Sign In.
2. Sign in using **JHEDID@jh.edu** (**NOT @jhu.edu**) and your password.
3. When you land on the Office.com home screen, you can click **Install Office** in the upper right corner. Installing the software is optional; you can also use the web versions directly in the browser.



JHU Library

Students have online access to the [Johns Hopkins University library](#) for the duration of the course.

Communication

Course Announcements

Important announcements will be posted to Microsoft Teams in the **General** channel. They may also be cross posted in the relevant Module channel. Students should check for new announcements each day.

Public Questions via Teams Channels

Questions about the course should be posted in the relevant channel in **Microsoft Teams**. Students can post replies to questions from their peers, and this behavior is encouraged! In addition to written replies, it is also helpful to “like” posts by clicking on a post then selecting the thumbs-up icon.

The quickest way to get an answer to a question is to use the **@Question tag**. When typing a message, include the text @Question. A pop-up should appear, and the text “Question” should turn purple. Including this tag alerts the teaching team and helps distinguish the question from discussion posts.

Personal Questions via Teams Chat

Direct chat messaging should be reserved for content that is not relevant to the whole class (late assignment, accommodations, etc.). To start a chat group with your teaching team, select **Chat** on the left-hand menu of Teams and click the **New Chat** icon (🗉) above the chat list pane. Type in the names of all your teachers to add them to the group. **Please refrain from chatting with an individual teacher; instead, chat with the whole teaching team.**

Interacting with Peers

Students are encouraged to discuss the course content with their classmates. In addition to posting and replying to messages in the public Microsoft Teams channels, students can also use Microsoft Teams to chat with an individual student or groups of students.

Students must be respectful and reach out to the teaching team if they believe someone is behaving inappropriately. All students are bound by the Academic Integrity policy for the duration of this course, including time spent outside of the synchronous meeting time.

Grading

Submission Format

Documents should be submitted in PDF format. Videos should be created as .mp4 or .mov format, uploaded to Microsoft Stream, and shared via a link to the video.

Typed submissions are preferred, but handwritten work can be scanned or photographed and included within a Word document. One option is to use a program like CamScanner to

digitize handwritten work. Please take the time to ensure scans are not blurry, handwriting is legible, pictures are not sideways, and text and photos are not too small.

Late Policy

Unless otherwise noted, **all homework submissions are due before the start of the next synchronous class meeting**. Large files take time to upload, so students should not wait until the last minute to submit their work.

Because this course moves at a fast pace, in general, late work will not be accepted. **Submitting something on time is better than submitting nothing**. There are a few exceptions to this rule:

- All students will be able to submit one assignment or activity late (up to 12 hours late) with no penalty.
- The second late assignment (up to 12 hours late) will be penalized at 50% credit
- Exceptions will be made for genuine hardships experienced during the course.

Students should contact their teaching team as soon as possible to let them know why an assignment is late.

Grade Questions and Regrade Policy

Students may submit work to be regraded if they feel there is an error or if they have questions about how it was graded. Requests should be made via Teams chat with the teaching team within 48 hours of the grade being posted in Blackboard. The student should indicate what portion of the work should be regraded and explain the rationale for their request. The new grade may be higher, the same, or lower than the original grade. Once work is regraded, it may not be submitted for another regrading analysis.

Final Grade Letters

Final grades will be awarded as follows:

- Above 90% A
- 80% - 90% B
- Below 80% No credit - Audit

A grade of A indicates achievement of consistent excellence and distinction throughout the course—that is, conspicuous excellence in all aspects of the course assignments. A grade of B indicates work that meets all course requirements on a level appropriate for undergraduate academic work. Students who do not earn an A or a B will be marked as “audit”; they will not receive a final grade and the course will not appear on their transcript.

Students who earn an A or B grade in the course receive **3 credits** from Johns Hopkins University. If they are accepted to and matriculate as an undergraduate student at JHU, the credits awarded by JHU for this course are available to count towards their undergraduate degree at JHU. Credits may be applied towards the total required credits to graduate.

Students who complete the course (turn in all lab reports, design projects, and the final project) will receive a **Certificate of Completion** regardless of the grade they achieved. Certificates will be sent by email from ei@jhu.edu approximately two weeks after the last day of class.

Grade Calculation

Final grades will be determined by the following weighting:

Item	# of Points	% of Grade
Spaghetti Bridge Project	400	20%
Electronics Project	300	15%
Assignments	280	14%
Quizzes	240	12%
Class Participation	240	12%
Chemical Processes Project	160	8%
Request for Proposal Project	140	7%
Mousetrap Project	120	6%
Ethics Project	120	6%
Surveys	10 points extra credit	
Total	2000	100%

Major Deliverables

Spaghetti Bridge Project

Students test the material properties of spaghetti and use truss analysis (statics) to design, build, and test a bridge made of spaghetti and wood glue.

Instructions are posted to Blackboard in the **Materials** and **Statics** modules. The deliverables for the Materials labs are written lab reports. Students use provided data to complete a lab report for tension, then they collect data and complete a lab report for bending. Students then write the experimental methods, collect data, and complete a lab report for buckling.

The deliverable for the individual bridge design and build is the student's choice of either a poster, a written report, or a video presentation.

The points for this project are allocated as follows:

- 200 pts – Materials labs (tension, bending, and buckling)
- 100 pts – Group bridge design
- 100 pts – Individual bridge design, build, and test

In total, deliverables for the Spaghetti Bridge Project are worth 400 points (20% of the final grade).

Electronics Project

Students use [MakeCode](#) block programming, [JavaScript](#), or [CircuitPython](#) to control a [Circuit Playground Express](#) (a programmable circuit board with built-in sensors, buttons, and lights). After working in a group to build a memory game, students are given a design challenge: build a device that will help the user live a healthier life. Emphasis is placed on transferable skills like defining the problem, writing use cases, debugging, developing verification procedures, and creating documentation.

Instructions are posted to Blackboard in the **Electronics** module. The deliverables for the individual design challenge are the code, a user guide, and a demonstration video. Projects are then peer reviewed.

The points for this project are allocated as follows:

- 125 pts – Group project
- 145 pts – Individual project (code, user guide, demonstration video)
- 30 pts – Peer review

In total, deliverables for the Electronics Project are worth 300 points (15% of the final grade).

Assignments

Assignments are questions or activities designed to give you practice with the course content. Students should complete assignments on their own, not in a group.

Assignment links are provided in the corresponding Blackboard modules. Students are required to submit their work to Blackboard as a PDF file. All work must be shown and legible to earn full credit. Solutions without justification will not be considered complete and the grade will be adjusted down accordingly.

Each of the following assignments is worth 40 points:

1. Units and Dimensions Assignment
2. Excel Assignment
3. Error and Uncertainty Assignment
4. Statics Assignment
5. Finance Assignment
6. Electronics Assignment
7. Chemical Processes Assignment

In total, the assignments are worth 280 possible points (14% of the final grade).

Quizzes

Each module includes quizzes composed of multiple choice and fill-in-the blank style questions. Students should complete quizzes on their own, not in a group.

Quiz links are provided in the corresponding Blackboard modules. The quizzes are designed to test the concepts and skills covered in the module lectures, so students should plan to complete all lecture videos and readings before attempting the quiz. Quizzes are untimed, and students can attempt each quiz up to 2 times. Feedback on the quiz will be available after the quiz due date.

Each of the following quizzes is worth 20 points:

1. Engineering Design Quiz
2. Units and Dimensions Quiz
3. Technical Communication Quiz
4. Excel Quiz
5. Materials 1 Quiz
6. Materials 2 Quiz
7. Materials 3 Quiz
8. Error and Uncertainty Quiz
9. Ethics Quiz
10. Statics 1 Quiz
11. Statics 2 Quiz
12. Finance Quiz
13. Electronics 1 Quiz
14. Electronics 2 Quiz
15. Chemical Processes Quiz

The lowest **three** quiz grades will be dropped. So, the highest 12 quiz grades will count toward the final grade for a total of 240 possible points (12% of the final grade).

Class Participation

The class will meet for a synchronous three-hour session every weekday. Most of this time will be spent working in small groups to complete projects, conduct discussions, or solve engineering challenge questions. All students are expected to participate the activities.

A description of the activities for each meeting will be posted to Blackboard in the **Syllabus & Course Information** area. Additional instructions and files may be shared in real time during the meeting.

Participation is worth 12 points for each of the 24 meeting days. The lowest **four** participation grades will be dropped. So, the highest 20 participation grades will count toward the final grade for a total of 240 possible points (12% of the final grade).

Chemical Processes Project

Students design an experiment to convert cornstarch to sugar using an amylase enzyme. They calculate the percent conversion and the energy efficiency of the heating element.

Instructions are posted to Blackboard in the **Chemical Processes** module. The deliverable for this activity is a written lab report. The Chemical Processes Project is worth up to 160 points (8% of the final grade).

Request for Proposal Project

Students work in teams to imagine a new product or service in response to one of several Requests for Proposals (RFPs). They create a PowerPoint presentation to pitch the idea to their peers. This is an exercise in technical communication, finance, and the engineering design process.

Instructions are posted to Blackboard in the **Technical Communication** module. The Request for Proposal Project is worth up to 140 points (7% of the final grade).

Mousetrap Project

Students design a paper mousetrap and create instructions for how to build it. A classmate then attempts to recreate the device by following the instructions and provides feedback. This is an exercise in the engineering design process and technical communication.

Instructions are posted to Blackboard in the **Engineering Design** and **Technical Communications** modules. The **Mousetrap Design** is worth 70 points and the **Mousetrap Build** is worth 50 points, for a total of up to 120 points (6% of the final grade).

Ethics Project

Students learn about the National Society of Professional Engineers' (NSPE) code of ethics and apply it to one of several case studies. They read one or two provided articles, respond to short-answer questions, and construct an argument for peer review.

Instructions are posted to Blackboard in the **Ethics** module. The Ethics Project is worth up to 120 points (6% of the final grade).

Surveys

The Engineering Innovation office hires an **external evaluator** to assess the strengths and weaknesses of this course. Student feedback is essential to that process. Survey responses are anonymous; neither the teaching team nor the Engineering Innovation office can match students to survey responses.

A **pre-course survey** will be sent by email on or about the first day of class. A **post-course survey** will be sent by email during the last week of class. In addition, there are anonymous **weekly surveys** that are available in Blackboard. Your participation is voluntary.

Students that complete both the pre-course survey and the post-course survey will earn 10 points extra credit.

Policies

Academic Integrity

All students are required to read, know, and comply with the **Procedures for Dealing with Issues of Academic Misconduct**, as provided during enrollment.

This policy prohibits academic misconduct, including but not limited to the following: cheating, plagiarism, submitting the same or substantially similar work to satisfy the requirements of more than one course without permission, submitting as one's own the same or substantially similar work of another, knowingly furnishing false information to any agent of the University for inclusion in academic record, falsification, forgery, alteration, destruction or misuse of official University documents or seal.

Plagiarism is defined as taking the words, ideas, or thoughts of another and representing them as one's own. If you use the ideas of another, provide a complete citation in the source work; if you use the words of another, present the words in the correct quotation notation (indentation or enclosed in quotation marks, as appropriate) and include a complete citation to the source.

Disability Services

The Johns Hopkins University and the Engineering Innovation program are committed to making all courses, support services, and facilities accessible to students with disabilities.

To receive accommodations for a disability, students must register with the JHU Office for Student Disability Services (SDS) at <https://studentaffairs.jhu.edu/disabilities/>. Students are highly encouraged to do so as soon as possible after admission and no later than two weeks prior to the start of class. Although requests can be made at any time, there may be a delay in implementation depending on the nature of the request.

Part of the registration process is the submission of documentation of the disability. Please refer to the university documentation guidelines at <https://studentaffairs.jhu.edu/disabilities/newly-admitted-students/documentation-guidelines/> for more information.

You are encouraged to share this link with your provider (e.g. physician, psychologist, teacher/counselor, etc.) to help guide his or her writing, if necessary. Please know that IEPs and 504 Plans, although helpful, do not constitute comprehensive documentation. However, when combined with other documentation from a qualified evaluator, can provide adequate support for accommodations during your Engineering Innovation experience.

To begin the registration process with Student Disability Services and to establish eligibility for disability related accommodations and services, please complete and submit [the SDS Online Registration Form](#) and upload supporting documentation. You can also find this form by visiting the Student Disability Services website at <https://studentaffairs.jhu.edu/disabilities/> and clicking on the link on the left hand side labeled 'SDS Homewood Online Registration for New Students.'

Once your form and documentation are received, the next step in the process will be a phone call or virtual meeting with an SDS professional staff member, when needed, to complete your requested accommodations. If you have any difficulty providing documentation or need more information about any aspect of the process, please contact SDS staff at studentdisabilityservices@jhu.edu.

Director of Student Disability Services: Dr. Terri Massie-Burrell

Phone: 410-516-4720; **Fax:** 443-529-1543; **Email:** studentdisabilityservices@jhu.edu

Mailing address: The Johns Hopkins University; Student Disability Services; 3400 N Charles Street; Shaffer Hall Suite 101; Baltimore, MD 21218

Discrimination and Harassment

JHU will not tolerate harassment, sexual harassment (including sexual violence), discrimination or retaliation in the workplace or educational environment whether committed by managers, faculty, administrators, staff, or students, or by visitors to our institution of higher learning. If you are a victim of any such situation, you are strongly encouraged to file a complaint through official university channels.

You may reach out to the Engineering Innovation office at ei@jhu.edu or submit a Discrimination and Harassment Report Form to the JHU Office of Institutional Equity - <https://forms.jh.edu/view.php?id=164822>.